Biological Aggregations of Social Agents: Discrete Models and Data Analysis

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Abstract:
Biological aggregations are groups such as bird flocks, fish schools, and locust swarms in which organisms interact socially. They are striking examples of emergent phenomena, and simultaneously, they have served as the inspiration for the development of algorithms in robotics, computer science, mathematics, and other fields. There are three fundamental questions typically asked about aggregations. (1) What movement rules do individuals obey? (2) What are the macroscopic dynamics of the group? (3) How do individual movement rules relate to the emergent macroscopic behavior? This tutorial-style talk will address all three questions by introducing influential models of Vicsek and D'Orsogna, examining case studies involving locusts and aphids, and time permitting, discussing topological data analysis as an exploratory tool.